

a regular array, as shown, or an irregular array. However, it is to be understood that the presently disclosed photovoltaic device may have most any configuration of contact material **4**. A pitch of photovoltaic device **50** may range from tens of nanometers to tens of micrometers.

[0064] Absorber **2**, of thin film photovoltaic device **50**, may comprise a p-type semiconductor or a n-type conductor and first semiconductor **6** may comprise the other of the p-type semiconductor and n-type conductor. Second semiconductor **5**, disposed in the third layer 'c', may be configured to provide electrical communication between first contact **8** and second contact **4** solely through first semiconductor **6** and second semiconductor **5**.

[0065] Absorber **2** of thin film photovoltaic device **50** may comprise a p-type semiconductor and second semiconductor **5** may comprise the same or different p-type semiconductor. Alternatively, absorber **2** of thin film photovoltaic device **20** may comprise a n-type semiconductor and second semiconductor **5** may comprise the same or different n-type semiconductor. Second semiconductor **5** and absorber **2** may comprise at least one different material or they may comprise, or consist of, the same material.

[0066] The thin film photovoltaic device **50** may comprise a substrate **9** and first contact **8** may be disposed in first layer 'a' and have its lower surface disposed on substrate **9**. Second contact **4** may have an interrupted pattern and thereby only partially filling fourth layer 'd' and absorber **2** may fill the interrupts in second contact **4**.

[0067] Thin film photovoltaic device **50** may comprise first contact **8**, first semiconductor **6** disposed on first contact **8**, a second semiconductor **5** disposed on first semiconductor **6**, an interrupted second contact **4** disposed on second semiconductor **5**, and an absorber **2** disposed on second contact **4** and filling the interrupts in second contact **4**. Absorber **2** may comprise a p-type semiconductor and second semiconductor **5** may comprise the same or different p-type semiconductor. Alternatively, absorber **2** may comprise a n-type semiconductor and second semiconductor **5** may comprise the same or different n-type semiconductor. Second semiconductor **5** and absorber **2** may comprise the same materials or different materials. In the aspect of the photovoltaic device shown in FIGS. **5a** and **5b**, second contact **4** comprises an interrupted sheet or a sheet with an array of holes.

[0068] FIGS. **6a** and **6b** show photovoltaic device **60** with back contacts **4** and **8** and having a superstrate geometry. FIG. **6b** is a cross-sectional view of photovoltaic device **60** showing layers 'a1'-'f1'. Photovoltaic device **60** may be a thin film photovoltaic device and may comprise a superstrate **9.1** disposed in a layer 'f1' and having an upper surface and a lower surface, as shown in FIG. **6b**. In this aspect, superstrate **9.1** may comprise a transparent superstrate. Absorber **2** may be disposed in a second layer 'e1' and have an upper surface disposed on the lower surface of superstrate **9.1**. First contact **4**, comprising a first contact material, may be disposed in a portion of third layer 'd1' and have an upper surface disposed on the lower surface of absorber **2**. First semiconductor **5** may be disposed in a portion of third layer 'd1' and on a portion of the lower surface of absorber **2** and about first contact **4**. In this respect, layer 'd1' may comprise a portion of first semiconductor **5** and layer 'c1' may be solely comprised of first semiconductor **5**. First semiconductor **5** may comprise, or consist of, the same material as absorber **2**, or may comprise, or consist of, different materials. For example, absorber **2** may comprise a p-type semiconducting material and first

semiconductor **5** may comprise a different p-type semiconducting material. Second semiconductor **6** may be disposed in a fifth layer 'b1' and have an upper surface disposed on the lower surface of first semiconductor **5**. In at least one aspect of the present disclosure, first semiconductor **5** and absorber **2** may comprise the same or different n-type semiconductor and second semiconductor **6** may comprise a p-type semiconductor. In at least one other aspect of the present disclosure, first semiconductor **5** and absorber **2** may comprise the same or different p-type semiconductor and second semiconductor **6** may comprise a n-type semiconductor. Second contact **8** may be disposed in a sixth layer 'a1' and have an upper surface disposed on the lower surface of second semiconductor **6**.

[0069] Second layer 'e1' may be deposited on, disposed on, and/or adjacent to first layer 'f1', third layer 'd1' may be deposited on, disposed on, and/or adjacent to second layer 'e1', fourth layer 'c1' may be deposited on, disposed on, and/or adjacent to third layer 'd1', fifth layer 'b1' may be deposited on, disposed on, and/or adjacent to fourth layer 'c1', and sixth layer 'a1' may be deposited on, disposed on, and/or adjacent to fifth layer 'b1'.

[0070] FIG. **6a** shows a bottom view of photovoltaic device **60** having the second contact material **8**, second semiconductor **6**, and first semiconductor **5** removed therefrom. In this respect, a portion of layer 'd1' is shown having first contact material **4** and a portion of layer 'e1' is shown having absorber **2**. In this aspect, electrode or contact material **4** may comprise a perforated sheet, a sheet with substantially equal spaced holes, or a sheet with an irregular array of holes therein. The pitch may range from tens of nanometers to tens of micrometers.

[0071] FIGS. **7a** and **7b** show photovoltaic device **70** with back contacts **4** and **8**. FIG. **7b** is a cross-sectional view of photovoltaic device **70** showing layers 'a'-'f'. Photovoltaic device **70** may be a thin film photovoltaic device and may comprise a first contact **8** disposed in a first layer 'a' and having an upper surface and a lower surface, as shown in FIG. **7b**. A first semiconductor **6** may be disposed in a second layer 'b' and have a lower surface disposed on the upper surface of the first contact **8**. An insulator **11** may be disposed in a third layer 'c' and on an upper surface of the semiconductor **6**. Insulator **11** may comprise one or more electrically insulating materials. Insulator **11** is configured and disposed to insulate against electrical contact between second contact **4** and semiconductor **6**. Therefore, electrical communication between first and second contacts **8** and **4** is solely through semiconductor **6** and absorber **2**. In this aspect of the disclosure, insulator **11** may be in a form or shape like, or similar to, second contact **4**, partially filling layer 'c'. However it is to be understood that the insulator **11** may have a variety of configurations which insulate contact **4** from semiconductor **6**.

[0072] Second contact **4** may be disposed in a fourth layer 'd' and on insulator **11**. Absorber **2** may comprise a semiconductor and may be disposed in a fifth layer 'e' and about second contact **4**, insulator **11**, and first semiconductor **6**. Absorber **2** may be a semiconductor and may completely fill layer 'e' and partially fill layers 'c' and 'd'.

[0073] Optionally, photovoltaic device **70** may comprise a substrate **9** in layer 'f'. Substrate **9** may be configured and disposed to have first contact **8** deposited, or otherwise disposed, thereon and support layers 'a'-'e'. In at least one aspect of the present disclosure, photovoltaic device **70** is void of substrate **9** and first contact **8** may be configured and